mucous membrane becomes ulcerated, when the cheesy masses in the middle ear and mastoid undergo decomposition and when there is caries of the temporal bone or involvement of the meninges. There may be a rise in temperature, dizziness, vomiting, loss of equilibrium and nystagmus, these latter symptoms being, of course, the indication of the beginning of one of the various brain or labyrinth complications. During the suppurative stage these head symptoms will increase if the discharge stops (owing to obstruction), and they will diminish or stop altogether if the obstruction be removed so as to permit of free drainage.

The subjective noises are usually intermittent but may be continuous, especially in anemic, cachectic, hysterical or nervous individuals, in syphilitics and when we have a combined adhesive process of more or less long standing.

Diminished or total loss of the sense of taste may be noticed by the patient owing to involvement of the chorda tympani nerve or tympanic plexus. Disturbances of hearing will vary greatly in different patients and at different times, depending upon the amount of suppuration, the varying degrees of swelling and destruction of the musous membranes, the permeability of the eustachian tubes, the presence of adhesions or ankylosis of the ossicles, the condition of the oval window and the presence or absence of labyrinth involvement. After the suppurative process has run its course, the degree of hearing disturbance will depend upon the permanent pathologic changes remaining in the middle and internal ears.

Objective Signs and Symptoms.—Tenderness on pressure over the mastoid, foul smelling discharge from the external meatus, sinking of posterior superior wall, and the presence of polypi and granulations in the external meatus. The presence of blood in the discharge usually points to polypi and vascular granulations.

Drum perforations are most frequently anterior-inferior or posterior-superior. They vary from pin-hole perforations to complete drum destruction, being greatest in scarlet fever, diphtheria, tuberculosis, diabetes, and syphilitic middle ear suppurations.

They may be round or oval, elliptical or semilunar, angular, heart-shaped or kidney-shaped and they may or may not extend to the margin, involving the annulus tympanicus. Multiple perforations usually mean tuberculosis. The margin of the perforation may remain free or become attached to the promontory wall itself, which will undergo changes varying from slight tumefaction or thickening to the presence of large granulations and polypi extending through the perforation. The ear ossicles are present in varying degrees and they may be partly or completely destroyed. Calcifications of various shapes and sizes may be present in the remains of the membrane. Perforations extending to the margin of the annulus tympanicus usually indicate the presence of bone necrosis at this point.

Perforations in Shrapnell's membrane may indicate a primary suppuration located within the attic, but more frequently a generalized suppurative process of the entire middle ear, which has cleared up and localized itself within the attic. These suppurations may produce very little disturbance of hearing and may run their course for years without symptoms, or they may be accompanied by intermittent ear pains, hemicranial headache, a feeling of pressure and heaviness and violent attacks of dizziness, these latter symptoms being usually associated with the formation of granulations and cholesteatoma in the attic and with caries of the external attic and labyrinth walls.

The terminations of chronic middle ear suppurations are, (a) cure with complete restoration of hearing, (b) disturbances of hearing of different degrees up to complete deafness, (c) desquamation and formation of cholesteatoma, (d) ulceration and carionecrosis in the temporal bone, with chronic mastoid and labyrinth changes, (e) the development of an acute exacerbation with all the symptoms of an acute middle ear suppuration, acute mastoid symptoms and acute labyrinth and brain symptoms.

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THE PREVENTION AND TREATMENT OF LOCALIZED MUSCULAR CONTRACTURES.

By A. GOTTLIEB, M. D., San Francisco.

Muscular contractures following injuries or fractures in the vicinity of joints are frequent causes of limitation of motion not alone of the joints involved, but of the distant joints of the extremity as well. Such contractures result in loss of time to the injured, and reduce his working efficiency for a long time.

The production of post-traumatic localized myogenic contractures is ascribed to immobilization of injured joints in the same position for a continuous period of time. Immobilization antagonizes the circulation and nutrition, lessens the power of absorption and favors the organization of inflammatory exudates in the injured limb.

The various theories advanced to explain the physiologic mechanism in the production of localized myogenic contractures, I will not discuss in this place. They all attempt to prove the same truth, namely, that the existence of peripheral irritation is required to maintain continuous localized contraction of a muscle or muscle group, and that this latter leads to the resistant contractures. The seat of irritation is sought by some writers (Goldschneider,[1] Przhevalski[2]), in the sensory nerve endings of the muscle tendons; by others (McDougal,[3] Cooper[4]), in the nerve distribution within the muscle proper. All conclude that in the injury of the soft structures and in the lack of their normal metabolism lies the stimulus for the irritation of the nerve endings. Continuous muscular contraction is the method adopted by nature to secure rest; it is a wise and purposeful arrangement; but when this helpful aid is too persistent and excessive, it does harm by leaving the muscles in a lasting spastic contraction. Serious damage to the structure and the function of the muscles may

result from this continuous spasm, since fibrotic changes take place within the muscles. If precautions are not taken in the early period of treatment, resistant and troublesome contractures will result. These precautions are expressed in the early application of medico-mechanic treatment.

Our limitation in the prevention of this form of contractures is based upon the necessity of immobilizing neighboring joints to secure rest for the injured tissues, which is a *sine qua non* for the process of repair of bone or of soft structures.

Immobilization, as such, in the formation of contractures is only a minor factor, but in conjunction with an acute injury or a recent fracture, it does lasting harm. Therefore when fixation appears necessary, its duration should be shortened to the least possible time consistent with the character and the extent of the injury, and so bring about the release of the contracted tissues at the earliest moment, when functional treatment should be instituted. This treatment consists in massage and exercises. Massage effects the early absorption of inflammatory exudate and promotes local metabolism. It should be given at first for about 5 minutes; only gradually should the time be increased. I wish to emphasize that this massage, which should be very gentle in the beginning, can and should be executed by the surgeon himself; it should not be turned over to the masseur who is not efficiently trained for this kind of work. More harm than good may result from inefficient massage.

The physiologic effect of exercises is similar to that of massage. It is of inestimable value in the prevention of contractures. The exercises consist in assistive and resistive movement of the joints. Not only should the joint, in or near which the injury has occurred, be manipulated, but the distant joints of the extremity as well. Assistive movements are given first, and only after the muscles have gained in strength, are resistive exercises added. In applying massage and exercises precaution should be taken against the causation of muscular spasm; the latter always indicates that the muscle has been overstimulated and gives notice that further manipulation will be harmful.

The treatment of developed muscular contractures is divided into medico-mechanic and operative measures. The latter I will not discuss. The medico-mechanic treatment aims to restore the metabolic function of the affected muscles and to overcome the muscular resistance which limits the motion of the joints in question.

According to Lange,[5] 83% of contractures were curable by medico-mechanic treatment, while in only 17%, where conservative measures failed, was it necessary to resort to operative procedures. G. G. Cooper[1] attributes the cure of most myogenic contractures to the nonsurgical measures and highly recommends their application. The same opinion is expressed by Pelteson[6] and many other European surgeons who have used various medico-mechanic means to restore normal function to many cases of muscular contractures which have followed fractures and manifold injuries sustained on the battlefield of war.

Before the application of massage and exercises, the deformed extremity is exposed to either radiant or convective heat, to light or to electrically generated heat, i. e., diathermy.

The influence of radiant and convective heat and radiant light upon the contracted muscles is based upon the evolution of heat within the tissues. The induced hyperemia exerts important local influence: the tissues relax, the tension is relieved, the blood vessels dilate and a fresh supply of arterial blood invades the area. The fibrous changes within the muscles have constricted the vessels and exsanguinated them. The evolved heat softens the fibrous tissues, opens them up and thus promotes metabolic changes within the muscles. For the application of radiant heat I employ the incandescent light, the arc lamp or the electric bath cabinet. I use the radiant heat in preference to the hot air bath, because I believe that local metabolism is influenced not only by the heat alone, but that the penetrating rays of light have a chemical action upon the tissues, inducing oxidation and promoting metabolism.

No method of heating the tissues surpasses the use of diathermy, by which is meant heating of the tissues by an electrical current of high frequency. The advantage of producing heat in this manner are that the heat can easily be measured and localized, without, however, the unpleasant sensation usually associated with an electric current. Further, without unduly heating the skin, a uniform current of heat passes from one electrode to the other, heating the tissues which lie between the electrodes. For the application of this treatment I use the Tesla high frequency apparatus.

Following the process of heating, mechano-therapeutic treatment is given. This consists in appropriate exercises and massage which are carried out manually. It is an erroneous belief that costly appliances are necessary for this kind of treatment. The best results are obtained without complicated apparatus, as is practiced successfully in Europe during the present war. I wish to emphasize the value of effleurage or stroking in the direction of the lymph flow and the importance of active exercises in the treatment of contracted muscles. Effleurage favors nutrition of the tissues by increasing the circulation within them. Stroking of the part in the direction of the venous and lymph flow empties the veins and the lymph vessels; fresh blood and lymph again fill the vessels from behind and thus a continuous current of these nutritive fluids is promoted.

By active exercises are understood all those movements which are voluntarily executed by the patient to overcome resistance. The operator only assists or resists these intentional movements. Assistive exercises aim to diminish the resistance offered by the contractures; they should by no means become forcible, because any violent stretching will rupture the tissues, cause hemorrhage and further restrict motion. The most valuable of all movements in these cases are the resistive exercises. These are carried out by supplying resistance to active movements. Resistance is offered either by

the hands of the operator or by mechanical means; the former is preferable to the latter, because exact dosage and regulation of the resistance, in other worths, individualization of motion, cannot be supplied by any apparatus, whether a Zander, a Herz or a Krukenberg. No mechanical device is able to perceive that slight increase of spasm which follows when the contracted muscles are irritated through overwork. To the experienced hand of the operator this spasm, mild as it may be, serves as an indicator that further motion must be suspended, lest harm may ensue.

CONCLUSIONS.

1. The injured or fractured extremity should be immobilized not longer than consistent with the repair of the tissues.

2. To prevent muscular contractures, functional treatment, mechano-therapy, must be instituted at the earliest possible time.

3. Medico-mechanic measures are to be applied persistently for the cure of myogenic contractures; only after failure of a thorough conservative treatment should forcible stretching be undertaken.

Discussion.

Dr. J. Rosenstirn: The various methods of massage and thermo-therapeutics have developed into a specialty which is somewhat foreign to the general surgeon. For a great many years I have condemned too long immobilization of fractures, and I believe it has been recognized that those surgeons who do not over-extend the period of immobilization of fractures get the best results. For contractures I have seen excellent results from Dr. Gottlieb's therapeutic measures, and I believe that the judicious employment of such measures, carried out for a more or less prolonged period, will give excellent results and do away with our brutal breaking of adhesions and brutal extensions which were practiced up to a few years ago.

Dr. Harry M. Sherman: I am very glad to be asked to speak on this subject, because I have had to do with some phases of it and have had experiences different from those which Dr. Rosenstirn has mentioned. Immobilization for a traumatized tissue must be persisted in until the trauma has been recovered from so that mobilization shall not reproduce in any phase a return of the traumatized condition. A fractured bone must be held until it is consolidated; mobilization before that time will only end in slipping or bending of fragments and failure to get the anatomical result desired. I am willing to agree that after the bone has healed further immobilization is unnecessary, but if I were to choose between keeping the splint on too long, or removing it too soon, I should prefer keeping it on too long.

I am perfectly delighted to agree with Dr. Gottlieb about massage—I think it is one of the most dangerous things in the hands of people who pretend to be experts.

The late Dr. McMonagle at one time had patients massaged by a Swedish woman, and they all had very long convalescences; after a while he had it done no more, and his patients made more comfortable and quicker recoveries. Massage requires effort on the part of the patient in accepting and tolerating it. It can easily exhaust, or retraumatize.

Massage in bone and joint cases must be given with the full knowledge that on one side you have a strong person, on the other a bone, and **between them traumatized tissue,** which is wholly at the mercy of the masseur. Head work rather than hand work is needed here and it is sometimes hard to get. Recently I had a girl in whom we were trying to get an increase in elbow joint motion. I talked to the masseuse and told her how I wanted her work done and that it should **not be permitted to hurt,** but this woman could not understand that force must not be used; she gave pain, she did harm, and the treatments had to be stopped. Brisement is always reprehensible; the man who does it takes a greater chance than the man who goes to war; he will do damage more frequently than good.

I always allow children to work their own joints loose without any massage or baking; if a child cannot get its own joints loose, no one else can.

Some of the disabling, crippling conditions near joints are outside of the muscles entirely, as in a case of extreme equinus—one due to spina bifida occulta, on which I had operated when the patient was a baby—where the lesion was in a plaque of fibrous tissue behind the joint, under the tendo-achillis. No mobility was given the foot by the section of the tendo-achillis, and a cutting of the fibrous tissue through an open incision from the inner to the outer sides of the back of the joint, including the posterior ligament, was necessary. Another girl had this same deformity, due to a burn on the front of the leg and neglect of the position of the foot during a tedious healing. I found the same obstruction to dorsal extension of the foot, and had to treat it in the same way.

Dr. George J. McChesney: I would like to ask Dr. Gottlieb whether he finds any difference in therapeutic efficiency in the use of the X-ray, or baking by means of electric light or by the use of heliotherapy, and if he has compared the use of radium with these.

Dr. Gottlieb: The object of reading my paper was to bring to your notice such conditions as are frequently turned loose without treatment. These patients usually land in the hands of osteopaths, chiropractors, naturopaths and other so-called doctors. It is time that for these cases medico-mechanic measures should be applied by the orthopedic or the general surgeon.

With Dr. Sherman's remark I wish to disagree. I did not say that the immobilization should be discontinued; but that while the extremity is immobilized as long as consistent with the process of repair, active and, in time, resistive exercises should be given.

To the question of Dr. McChesney, I wish to answer that I have not applied X-ray or radium in these cases.

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ARCH DEFECTS OF THE HUMAN FOOT.

By ETHAN H. SMITH, M. D., San Francisco.

In the past the profession of medicine has given all too little attention to defects of the arch of the human foot. They have either not paid heed to it at all, or have heedlessly sent the patient to a shoe store or instrument house, with advice to secure a "good arch support." They have never taken the trouble to find out whether or not such a thing as a good arch support was on the market, taking it for granted that because they were on sale they must necessarily accomplish the purpose for which they were made.

It is impossible to properly treat defects of the arches of the feet without understanding the pathology that is present in such cases.